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Physico-Chemical Characterization of Selected Germplasms of Pummelo (*Citrus grandis* Osbeck.)

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Abstract

Present study was made by collecting fruits and primary data of plant characters from the selected 12 germplasms of pummelo from six districts of West Bengal. The study suggests that commonly the plants are seed propagated, regular bearer and fruit maturity occurs between September—December. Yield, plant growth i.e. height, basal girth, plant spread increased with age and H2 recorded highest among them with 120—130 fruits/year. B3 recorded moderately higher results in respect of all physical parameters, along with least seed number, which altogether proved it most desirable germplasm. No such single germplasm was found which was most superior in respect of all chemical characters. Five germplasms (B1, N1, H1, H2 and No 1) showed moderately desirable results in respect of these characters. Corresponding physical and chemical parameters of H1, B3, H2 and B1 scored best among the 12 selected germplasms.
Key words : *Citrus*, Pummelo, Germplasm, Physico-chemical characterization.

India stands fifth in the world with 5,677 thousand metric tons of citrus production. Collectively in India citrus fruits rank third in area and production after mango and banana, and accounts for 14.86 and 12.6% of the total area and production (1). Pummelo is one of the major monoembryonic species of citrus, grown in India and in many countries of the world. It is botanically *Citrus grandis* Osbeck. belongs to the family Rutaceae. It is considered to be the ancestor of grapefruit (*Citrus paradisi*) and supposed to be originated in the island east of Malaya (Malaysia) Archipelago including Fiji and Friendly Island (2) or in China (3). Pummelo usually have high amount of juice and high vitamin C (4). Moreover, the crop is with high level of bioflavonoides which have variety of clinical uses (5). Furthermore, flower, leaves and fruit peel of the crop content citronellal (23.88%) and limonene (52.96%) (16) which have tremendous economic importance. The crop performance in arid region with little irrigation is also good (6). Stressing on the multidimensional aspects pummelo should have got the importance which definitely demands the identification of elite germplasms and its subsequent utilization through proper plant characterization. Hence, the present investigation was undertaken for physico-chemical characterization of 12 selected germplasms of pummelo.

Methods

The present investigation was carried out at Post-Graduate Laboratory, Department of Fruits and Orchard Management, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal. The experimental material consisting of 12 germplasms of pummelo were selected from six districts of West Bengal viz. B1, B2, B3, B4 (Birbhum); Ba1 (Bardhaman); H1, H2 (Hooghly); N1, N2 (Nadia); No 1 (24 pargana North) and S1, S2 (24 pargana South). Fruits from the selected germplasms were collected during September—December. Three matured fruits from each plant were collected and brought to the laboratory for further analysis. The parameters of the plant type character were taken following the IBPGR guidelines (1988). The characters were recorded on the basis of field observation and information from the growers. Physical parameters were determined by usual method of measurement and counting. Chemi-

Table 1. Field characters of the pummelo germplasms selected from different localized regions of six districts of West Bengal.

Name of the Location	CODE	Age of the plant (years)	Source	Canopy type	Bearing habit	Average fruits/ year	Harvesting time	Height (m)	Basal girth (cm)	Plant spread (m) East-West	Plant spread (m) North-South
Birbhum											
Ratanpalli	B1	11	Budded	Open	Regular	45-60	Oct	4.63	46.98	3.42	3.71
Mahidapur	B2	15	Seeded	Open	Regular	50-60	Sep	5.07	48.72	4.81	5.06
Surul	B3	12	Seeded	Erect	Regular	30-40	Oct	4.72	46.57	3.92	4.23
Sriniketan	B4	16	Seeded	Erect	Regular	40-60	Dec	6.58	48.25	5.33	5.51
Bardhaman											
Kalna	Ba l	20	Seeded	Open	Regular	70-80	Nov	6.82	53.34	5.64	6.08
Nadia											
Pairadanga	N1	22	Seeded	Open	Regular	75-80	Sep	5.98	72.73	6.01	6.23
Kalyani	N2	12	Seeded	Open	Regular	40-50	Oct	5.28	49.28	5.15	5.43
Hooghly											
Vikdas	H1	26	Seeded	Erect	Intermediate	100-120	Oct	7.31	66.39	6.78	6.95
Hooghly Ghat	H2	32	Seeded	Open	Regular	120-130	Oct	7.62	88.89	7.73	8.02
North 24-Parganas											
Amdanga	No. 1	18	Seeded	Erect	Intermediate	80-90	Oct	6.09	53.84	5.94	6.21
South 24-Parganas											
Baruipur	S1	20	Seeded	Erect	Regular	80-100	Dec	5.88	58.35	6.17	6.58
Narendrapur	S2	28	Air layered	Open	Regular	800120	Dec	6.53	60.96	6.55	6.83

cal parameters were analyzed using standard methods of the AOAC (7). Ascorbic acid content was determined by titration method (8). Following physical and chemical parameters were measured taking three selected fruits from each selected plant. Data recorded from these experiments were analyzed by complete randomized design with 12 treatments (germplasms) and three replications (9).

Results and Discussion

Result of the assessment of plant type characters of selected clones revealed that mainly two types of stature and canopy of pummelo germplasms were noticed during survey, plants erect, more vertical than lateral, canopy closed, i.e. branches growing inward towards top; and plants canopy open, more lateral than vertical i.e. branches growing outward (Table 1). Observations showed that most high yielding germplasms had open dome shaped canopy structure. Ghosh et al. (10) also described that most of the pummelo plants are spreading with round top. Among the germplasms all of them except B1 and S2 were raised out of seed. Whereas, the germplasms B1 and S2 were propagated through budding and airlayering, respectively. Regular bearing habit was found in all germplasmas except H1 and No 1 in which intermediate between regular and alternative type of bearing habit was observed. Usually the relatively younger germplasms of 10—16 years of age like B1, B2, B3, B4, and N2 had lower number of fruits per plant. The germplasms exceeding this age usually had more number of fruits per plants. The germplasm H2 had the record of highest number of fruits per plant (120—130 fruits/plant) in this survey. Cedeno et al. (11) reported that frit production of the pummelo plants increased with age, from 40 fruits/plant in 4-year old tree to over 60 fruits/plants on 6 years old situation. Fruit harvesting time of the germplasms varied from September—December in different locations surveyed. Because of difference in age of different germplasms in the study, plant height, basal girth and plant spread differed accoddingly. But germplasms of all age group under study showed higher plant spread towards north-south than east-west. Again in some cases (B3 and N2 both were of 12 years age;

Table 2. Physical characters of fruit of selected pummelo germplasms.

Treatment	Fruit weight (g)	Peel thickness (cm)	Circumference of fruit (cm)	100 seed weight (g)	Pulp weight (g)	Seed no./fruit	Locule no./fruit	Amount of juice (ml)
B1	708.33	0.90	41.07	50.07	239.00	67.00	12.67	277.00
B2	958.33	0.84	41.53	51.66	268.33	92.67	13.33	283.33
B3	900.00	0.97	42.33	43.97	277.33	30.00	12.33	254.67
B4	928.33	0.92	37.50	36.96	212.67	33.67	13.00	190.00
Ba1	810.00	0.90	39.67	40.83	230.67	116.67	12.33	252.33
N1	591.67	0.99	39.12	20.13	122.67	53.00	13.00	184.33
N2	830.00	1.06	40.75	40.43	242.67	51.67	13.33	301.00
H1	990.00	1.04	46.03	47.63	264.33	94.67	14.00	278.67
H2	965.00	1.14	45.43	27.70	271.00	33.00	12.33	256.00
No1	615.00	0.83	36.53	14.00	162.33	104.33	11.33	143.00
S1	823.33	1.07	41.10	34.73	167.33	91.00	11.67	205.00
S2	600.00	0.97	36.88	17.66	199.33	70.00	14.00	164.33
SE ±	029.31	0.07	0.85	01.53	06.69	05.52	0.54	08.32
CD at 5%	085.58	0.20	2.50	04.49	19.60	16.16	1.57	24.35

and Ba 1 and S1 were of 20 years age) differential results were recorded for all these three characters. This may be due to the environmental effect and geographical diversity besides of genetic make up.

There was significant variation in physical characters of fruits among the selected germplasms. Table 2 revealed that higher fruit weight was found in HI (990.00 g), H2 (965.00 g) and B2 (958.33 g). Maiti et al. (12) found fruit weight variation in 15 selected genotypes ranging from 625—2,010 g. Whereas, peel thickness were comparatively lower in No1 (0.83 cm) and B2 (0.84 cm). Again, fruit circumference was higher in fruits of H1, H2 and B3 i.e. 46.03 cm, 45.43 cm and 43.97 cm, respectively. Moreover, among the selected germplasms B3 and H2 had higher fruit of pulp 277.33 g and 271.00 g and lower seed contain 30 and 33 per fruit. Number of locules per fruit was maximum in fruits of H1 (14.00). Murthy et al. (13) found highest locule number of 18.85 per fruits from six fruit shape type of pummelo. Highest amount of juice (301.00 ml) was obtained from N2 but higher result also found from B2, H1, B1, H2 and B3. Bharali and Saikia (14) reported the highest juice volume of 205.50 ml for selected white fleshed pummelo. So among the 12 selected germplasms H1, B3, H2, B2 and N2 scored well in terms of physical parameters.

Table 3. Chemical characters of fruits of the selected germplasms of pummelo.

Treatment	TSS^0 Brix	Reducing sugar (%)	Total sugar (%)	Acidity (%)	TSS: Acid ratio	Vitamin C (mg/100ml of juice)
B1	9.17	2.67	3.81	1.11	8.26	61.70
B2	8.17	2.11	3.53	1.03	7.93	40.87
B3	8.37	2.53	3.17	1.13	7.40	38.37
B4	8.23	2.16	3.39	1.15	7.15	56.77
Ba1	8.90	2.41	3.35	1.02	8.73	61.00
N1	9.80	2.04	3.57	1.21	8.10	43.07
N2	8.80	2.50	3.51	1.42	6.20	54.73
H1	6.80	2.26	3.77	1.23	5.53	75.47
H2	9.00	2.52	3.54	1.07	8.41	56.90
No1	9.67	2.36	3.83	1.19	8.12	40.67
S1	8.27	2.12	3.48	1.34	6.17	70.73
S2	9.00	2.41	3.65	1.45	6.21	56.63
SE±	0.09	0.05	0.06	0.04	0.26	0.43
CD at 5%	0.28	0.15	0.17	0.11	0.76	1.26

Chemical characters of the fruits of selected germplasms showed significant variation. N1 showed highest TSS (9.80 ^{0}Brix) followed by No1 (9.67 ^{0}Brix) and B1 (9.17 ^{0}Brix) (Table 3). Total sugar and reducing sugar were found to be higher in No1, B1, B3, H1 and H2 germplasms. TSS : acid ratio was higher in Ba1 (8.73), H2 (8.41) and B1 (8.26). Bharali and Saikia (14) reported highest sugar acid ratio of 9.32 in white fleshed pummelo. Vitamin C content in fruits was significantly higher in H1 (75.47 mg/100 ml juice) and B1 (61.70 mg/100 ml juice). Liu et al. (15) reported average ascorbic acid content of 55.90 mg/100 ml fruit juice in Shanghang pummelo. No such single germplasm was found which was superior in respect of all chemical characters. Five germplasms (B1, N1,

H1, H2 and No1) showed moderately desirable results in respect of these characters. Corresponding physical and chemical parameters H1, B3, H2 and B1 scored best among 12 selected germplasms.

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